

Improved Streamflow Forecasts

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While the current climatological and statistical-based procedures used by the Montana Area Office (MTAO) provide reasonable guidance for watershed and reservoir-river system operations, there is room for improvement as more accurate and reliable forecasting methods evolve. There are two types of forecasts that are important, viz., precipitation and temperature (weather) forecasts and snowmelt and rainfall runoff (hydrologic) forecasts. Both types will be improved as numerical models continue to develop and as better hydrometeorological data are provided for input to the models. Benefits from improved weather and runoff forecasts should lead to more efficient reservoir operations, including:

- Improved scheduling of releases for flood control and risk reduction
- Providing alerts for canal overspilling during floods and heavy rainfall events
- Improved scheduling of flushing flows and fishery releases
- Better irrigation scheduling for water conservation and improved water quality
- Improved scheduling of conservation releases for regulation of river systems for aquatic ecosystems
- Improved scheduling of releases for power generation
- Improved scheduling to provide more desirable lake levels for recreation

The goal of this project is to develop tools that will improve seasonal runoff and daily streamflow forecasts. The project objectives are:

- Provide mid-month seasonal runoff/inflow forecast updates to allow for faster reservoir operations response as current snowpack, precipitation and other weather conditions change.
- Provide a new parallel approach for enhancing seasonal runoff forecasts by incorporating National Centers for Climate Prediction (NCEP) Climatic Outlooks as input to the forecasts.
- Improve the usefulness and accuracy of short-term streamflow and river

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stage forecasts.

- Investigate the benefits of using near real-time NEXt generation weather RADar (NEXRAD) precipitation estimates for enhancing operational water resources decision making.

Project work on the objectives during FY 1999 was as follows:

Objective 1: The MTAO worked on this objective. The Tiber Basin was selected as a test site. Historical mid-month precipitation and snow data, primarily from the Natural Resources Conservation Service (NRCS) SNOTEL stations, were collected for this test basin. Mid-month seasonal forecast procedures were developed for the Tiber Basin. Operational testing of these procedures is planned for the 1999-2000 snowpack runoff season.

Objective 2: A survey was made of what information is available in the long-range Climate Prediction Center (CPC), NCEP Climate Outlook products. Verification for the 1-month and 3-month Climate Outlooks indicates that temperature forecasts were better than the precipitation forecasts. The verification of the 3-month precipitation climate outlooks showed essentially no difference from climatology, except during strong ENSO (El Niño or La Niña) episodes. This means that at present, the 1-3 month temperature forecasts show some skill, but the precipitation forecasts show no significant skill except during ENSO events. Project plans are to evaluate other CPC long-range forecast products during FY 2000.

Objective 3: Contacts were made with staff at the National Weather Service (NWS) Missouri Basin River forecast Center (MBRFC). This included pursuing a request to include streamflow values in kcfs for all forecast points and to have additional forecast points added to the model used by the MBRFC. Present plans are to use temperature and precipitation forecasts from the NCEP medium-range forecast (MRF) model's gridded fields in preparing operational short-range (out to 7 days) forecasts for the Upper Missouri Basin.

Objective 4: Due to the FY 1999 RTT budget cut for this project, all work on this objective was delayed until FY 2000.

Partnerships were developed with the NWS MBRFC (improvements on short-range streamflow and river stage forecasts), CPC/NCEP (Climate Outlooks and MRF Model gridded field data), and the NRCS (SNOTEL data and mid-month seasonal forecasts). A new partnership is being developed with the GEWEX (Global Energy and Water-cycles Experiment) Continental-scale International Project (GCIP). The goal of this partnership is to demonstrate the practical utility of GCIP enhanced NWS forecast products for water managers and water conservation districts in the Upper Great Plains Region of the Upper Missouri River Basin. Another partnership is being pursued with the Corps of Engineers in Omaha for a study related to calculating evaporation from reservoirs without using evaporation pans. Reservoir evaporation is a significant factor in determining available water supply.

Project related NEXRAD radar precipitation estimates over the Upper Great Plains Region are displayed on Reclamation's River Systems and Meteorology Group's World Wide Web page on the Internet (<http://www.usbr.gov/rsmg/>).